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ABSTRACT

Developed under a contract with the International Council on Archives, these guidelines are designed to emphasize the role of automation techniques in archives and records services, provide an indication of existing computer systems used in different archives services and of specific computer applications at various stages of archives administration, and discuss the current status of information retrieval technology. General principles including infrastructure and training are presented; the functions of input, processing, output, and evaluation are discussed; and systems specification and the systems analysis stages of data capture, data entry, and data structure are considered. In addition, examples of specific applications are given, including records management, accessions registration, the construction of finding aids, user services, and automation in support of management. Problems centering on hardware, software, staffing, costs, systems planning, and small archives are also considered along with their solutions. A 55-item bibliography is provided. (KM)

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An Introduction to archival automation: A RAMP study with guidelines

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AN INTRODUCTION TO ARCHIVAL AUTOMATION :
A RAMP STUDY WITH GUIDELINES

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Nov 1985/Feb 1986

Michael Cook

PREFACE

In order to assist in meeting the needs of Member States, particularly developing countries, in the specialized areas of Archives Administration and Records Management, the Division of the General Information Programme has developed a long-term Records and Archives Management Programme - RAMP.

The basic elements of RAMP reflect and contribute to the overall themes of the General Information Programme. RAMP thus includes projects, studies and other activities intended to :

- develop standards, rules, methods and other normative tools for the processing and transfer of specialized information and the creation of compatible information systems ;
- enable developing countries to set up their own data bases and to have access to those now in existence throughout the world, so as to increase the exchange and flow of information through the application of modern technologies ;
- promote the development of specialized regional information networks ;
- contribute to the harmonious development of compatible international information services and systems ;
- set up national information systems and improve the various components of these systems ;
- formulate development policies and plans in this field ;
- train information specialists and users and develop the national and regional potential for education and training in the information sciences, library science and archives administration.

The present guide carried out under a contract with the International Council on Archives emphasizes the role of automation techniques in archives and records services which have to deal in recent years with an increasing volume of records produced and an equal demand for access to information. It provides useful indication of existing computer systems used in different archives services and on specific computer applications at various stages of archives administration. It covers also, among others, the present development of information retrieval methodology. An important bibliography is included.

Comments and suggestions regarding the study are welcomed and should be addressed to the Division of the General Information Programme, UNESCO, 7, Place de Fontenoy, 75700 Paris, France. Other studies prepared as part of the RAMP programme may also be obtained at the same address.

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AN INTRODUCTION TO ARCHIVAL AUTOMATION

Michael Cook

This publication is intended as a preliminary guide to those who are considering whether or how they can introduce any of the techniques of automation into the administration of archives and records services. It gives information on the ways in which computer applications have been developed to assist with these processes, and suggests where sources of additional information may be found. It does not itself set out to give information of sufficient technicality or detail to enable a system to be set up, but instead it aims to provide a tool by which archivists and records managers, working in manual or non-automated services, may consider the value and functioning of automated systems, and make use of the experience of their colleagues in more technically advanced services.

Archives and records services form an essential part of the information management services of a country. They deal with information-bearing materials generated within the administrative systems of important organisations (whether governments or private institutions or organisations), while on the whole, library and documentation services deal with information-bearing materials bought in from outside. To play their part, it is essential that the archives and records services should operate efficiently within the limitations of available resources. This is all the more true as these services come under greater pressure because the increasing volume of records produced coincides with the expansion of demand for access to the information in them. Modern records and archives services have to deal with vast amounts of material, and have to find ways of exploiting their information content rapidly and accurately. They have to do this within the constraints of a budget which, never generous, has probably been subjected in recent years to new restrictions.

In this context, archives and records services cannot ignore the potential of automation. The additional power which computing gives to the management of any information service is likely to be of great - or even vital - significance to the success of that service. Computers can speed up the processes of collection, handling and retrieval of information, and can also extend the range of information supply and use. Introducing computers may solve some of the problems of carrying out processes in the service (especially those which depend on repetitious clerical work), and may help the service to be of more obvious and immediate value to its users.

Additionally, archives and records services cannot ignore the inevitability with which various forms of automation are coming to dominate administrative methods. The advance of new technology may be obscured and delayed in some developing countries, but its eventual coming is clearly charted. Elsewhere in the world, the new ways are being adopted rapidly. Information workers have to face a double challenge: they must themselves learn to use automated systems, because these are becoming standard, displacing more traditional systems; and they must learn to deal with the documents which have been produced by other people using the new technology, because these are the documents of the present age. Archivists must not only look at more automated ways of running their service and producing their finding aids, but they must now think of surveying and managing the records which have been created in machine-readable forms.

The advantages of automation have a cost, both in financial terms and in terms of change in the methods of work and attitudes of the staff. In fact, if the true costs of running a manual operation are calculated (and in the past these costs rarely were), and the true costs of introducing electronic methods are compared with them, the changeover is usually not found to be necessarily very expensive. However it is necessary to invest in new equipment, and this equipment needs infrastructural services and maintenance.

The systems which are to be used must be planned carefully, because if they are not well suited to the jobs which are to be done, they will not succeed. When computerised systems are in use, staff members will have to learn to do their jobs in ways hitherto unfamiliar. It may well be that in the long run automation will reduce the amount of routine work that has to be got through, by all grades of staff. However it is quite clear that it does not of itself reduce the need for numbers of staff, especially professional staff: what it does is increase the productivity of the staff, and so make it more likely that the service will be viable.

This manual supplements and to a degree replaces the earlier introduction to archival ADP, by Arad and Olsen, which was published by the Automation Committee of the International Council on Archives in 1981. A new manual was needed because of the rapid development of automated functions and services, and especially because of the following developments.

1. The wide distribution of cheap computers, particularly personal microcomputers and integrated office systems.
2. The enormous expansion of storage capacity available to electronic machines. This has changed their basic function from being machines which process data held on paper, to being machines on which information is originated, transmitted and then stored. A modern electronic system has in principle no need to use paper at all as a method of retaining information or putting information before its users.

3. The ready availability of software packages. Computers cannot be used unless they are suitably programmed. In the past, this programming had to be done by hiring programmers to devise a system for each service. Today it is easier to acquire a ready-made set of programmes, which carry out the standard functions. There are many examples of archives and records services which have used these packages, with or without adaptation. Information processing packages are frequently available without much financial investment.
4. The development of information retrieval methodology: this has meant that users in many countries are now accustomed to getting their information by accessing computer systems online. In other cases automatically constructed indexes or keyword retrieval has changed the way in which users are guided towards relevant material. This has changed user expectations, as well as giving new technical tools to information managers. In the most advanced countries, networks carrying bibliographical and documentary information (including archival information) are already in daily use, and descriptive formats are being developed to allow more information to be fed into these systems.
5. Other factors which have changed the climate of opinion and the way in which the information professions think and work have included the recent development of new data storage media, such as optical data disks; and sophisticated systems for displaying graphical information, and for transmitting documents in facsimile. Finally, we may note the growing movement for the harmonization of training between the information professions.

In writing this manual, an effort has been made to use the simplest possible language. Where technical terms have been used, they have been drawn from the Automation Committee's Elementary terms in archival automation (1984).

References in brackets in the text are to publications listed in the bibliography.

I. General principles

Electronic systems can be used to carry out all or most of the work which is done on data, that is upon items of information. Much of the work which is done within an archives or records service can be described as the processing of data. The data involved can belong to one of two kinds:

(a) data which is needed to deal with the archival or record material itself, considered as a mass of physical objects;

(b) information derived from the archival documents themselves.

An example of data about the physical material would be information needed to control the processes within the service. An accessions register contains information about consignments of archives received, and a work control system records when work is done on the materials (fumigation, boxing, repair, production for users, etc). This area of an archivist's work has been termed 'administrative control'.

An example of information derived from archival material would be a finding aid consisting of descriptions of groups or series of archives, or of individual documents. Other examples would be indexes or guides to the material. In some cases there is a need for calendars, or full-text transcription, of the wording of important documents. This area is referred to as 'intellectual control'.

Both kinds of data have to be generated or collected, and then processed, by the staff of the service. In this respect, archives and records services are not different from other kinds of organisation: therefore they can consider using some of the techniques for processing data which have been developed elsewhere. In fact, this observation is true as regards manual methods as much as electronic methods; but it is the appearance of computer systems which has stimulated archivists to look closely at the methods which have become popular in other types of institution.

Studying other people's methods means experiment. Fortunately this is no longer so far out of reach of the less well funded organisations and individuals as formerly. The many cheap and self-sufficient personal computers, with their software packages, which are now available, have spread a knowledge not only of computer operation but also of what can be done to handle data. Where small computers are available cheaply, the public experience can also be valuable to those considering a new system at work.

Infrastructure

There are some preliminary requirements without which it would not be useful to consider introducing automation. It is clearly necessary that there should be a reliable source of electricity. If the power supply fails unexpectedly data can be lost, and if it fluctuates many problems are caused. This may be a particular difficulty in developing countries, but the problem may also occur elsewhere if there is a supply difficulty.

There should also be suitable environmental conditions for machines. Modern computers do not require the careful environmental control of earlier models - personal microcomputers, for example, will normally work in ordinary office conditions, and do not require a carefully controlled dust-free atmosphere. On the other hand, all electronic systems include some electro-mechanical parts. Computers, for instance, do not have moving parts, and therefore do not wear out quickly from friction: however they do generate heat, and have to be cooled, often with fans. Data is stored on devices such as disks, which have to be read on disk drives which involve spinning them round. If the data is to be printed out, there must be a printer. Wherever there is machinery, however simple, there must be provision for maintenance and repair. A clean environment, and a habit of care are prerequisites.

Another infrastructural question is that of the siting of work stations - the places where the processing of data is actually to take place. The first internal collection of data about archives usually occurs in the workroom, where the material is being sorted. Is this a suitable place to put a terminal, so that the data can be entered at once? If not, then there must be some sort of preliminary data collection, and someone must write out notes which can be processed later. The extra work involved in this may reduce the value of the new system. Similarly, the place at which the data can be retrieved for use is of importance. If the data is needed in the searchroom, then it would be a nuisance if there was only one terminal which had to be sited in another building.

When terminals are placed within a room, there should be a suitable space for them. More than one person may need to sit at the console (because of training or team-work requirements). The screen should not have direct light or strong reflections on it, as this can cause eye-strain; but equally it would be wrong to put the equipment in a dark corner where operators cannot read their notes. There should also be space for these notes and working papers, which suggests that terminals should be put on tables or desks of a reasonable size. This means that any users of the terminal must be able to set out their working papers conveniently. A simple rule would be that a terminal table should not be smaller than the desk which was formerly used by the unit's secretary or principal clerical officer, using a typewriter.

Time is as important as place. A computerised system could hardly work well if the users could not access it at the times most convenient to them. If there is access to the system only at set times, this can be a serious disadvantage.

There must be the possibility of acquiring all the necessary equipment. This consists of hardware (the actual machinery), and software (the programs which govern the work). Both are usually provided when a computer system of any size is bought. Purchasers of personal computers should make sure that the software they get with the machine is suitable and effective. For some, hardware and software requirements can be provided by a central computing or data processing service, so that it is not always necessary to think of buying new material specially for the archives or records service.

However in both cases ease of access is important. If there is no way of getting access directly to the main equipment which is sited remotely, the system would have to be a 'batch mode' one, where everything has to be written out before processing into the computer can take place. Results would also have to be set out on paper and transmitted to where they were wanted. Today systems like this must be regarded as out of date. It is because the pioneering systems so often used batch mode that automated systems for a time got a bad reputation among archivists.

If access to the computer is near at hand, the system can be 'interactive' or 'online', data being sent in and retrieved directly. Modern systems are always interactive, and the advent of multiple remote terminals and cheap microcomputers have made them much more generally available.

Finally, the staff of the archives or records service must be regarded as an essential resource, and this includes all categories: managerial, professional and support staff. It is essential that all should receive appropriate training, and be willing to participate in the automated system. If there is no agreement on this, or if insufficient training is available, this again would be an enormous disadvantage. This aspect deserves more detailed consideration.

Training

The training which is provided to support any automated system should be specific and appropriate. This does not mean that it should be confined to simple instructions on what to do. All training has to have an element of theory or general principle, so that the staff members will have at least some understanding of how and why their system works, how it relates to comparable systems elsewhere, and how to assess its benefits in relation to its costs. The extent of this more general knowledge may vary. There are probably at least three levels at which training should be provided:

(a) at the managerial level: this is for the staff who are to plan and supervise the system in operation. Clearly such staff must have the ability to analyse the needs of their service and describe its objectives (systems analysis). They should be able to relate these needs to the capabilities of automated systems, and they should understand how these systems are used. They should also know something about comparable systems in other institutions, with their limitations and strengths, and should be able to predict the effects which a change of system would bring.

(b) at the professional level: professionals have to act in a managerial capacity in relation to the systems in use in their service, but are not necessarily called on to consider the planning of new systems strategically. They should have a good understanding of the principles underlying automated systems, and be able to apply this knowledge to their own situation. In addition, some of the skills involved in the mechanics of system operation would be useful.

(c) at the level of support staff. Principally, this will involve the actual processing of data, and so there would be a need for specific instruction in how to use the data entry machines (keyboarding), and how to give the necessary commands to make the equipment work and to obtain output. Maintenance staff also need to be instructed in the specifics of the system and its machines.

UNESCO (1984) has published a curriculum which is intended as a guide to the sort of training appropriate to information professionals. The publication of this curriculum is to assist the harmonization of training as between the different branches of the information professions. It is therefore intended to be useful in planning the training of archivists (managerial, professional and paraprofessional). A brief summary of what it covers may be useful here. (The curriculum also covers reprography, which, although it has points of overlap with automation, is not dealt with here).

(i) Word processing.

In general administration: the production and updating of records, office communications, and recording on disks, diskettes or magnetic tapes.

In archival management, the use of word processors to produce finding aids and help in administration.

(ii) Computing.

General computer appreciation, or understanding of how these machines may be used; the main types of hard and software, including some practical instruction. It is not thought necessary to learn a programming language, or how to write original programmes.

(iii) Telecommunications.

Although not universally applicable as yet, information systems using telecommunications are widespread, and the possibility of designing local networks through telephone or television services must always exist. Online access to information through such services may be required, and information is also available in many parts of the world through videotex or teletext. As these systems become an international standard in librarianship and documentation, it becomes necessary for archivists and records managers to know of them.

(iv) Data bases and expert systems.

Online data bases are an essential and growing feature of the world's information services. Some are international, some local. Practical instruction in using the command language of a data base system is thought to be useful. Expert systems bring technical knowledge to the workplace.

(v) Data storage technology.

Archivists and records managers must be able to handle the new media, including magnetic disks, tape and optical data disks, since inevitably many of the materials they have to manage are or will be held in these forms; this should especially be their area of competence.

The curriculum outlined above covers the subjects which would give a professional a broad understanding of the systems and methods which are being developed over the world in information services. It is not necessary that the full range of this training should be given in every case, or that systems development should be held back because a training in the full range of information technology is not available. However it should be emphasised that training should deal with understanding and evaluating systems, and not just with giving instruction in how to use particular ones.

A curriculum specifically for the training of archivists in automation has been published by UNESCO (Fishbein, 1986). This includes as subjects: the history and utility of ADP; technical information; administrative management and archival functions.

II. Functions and processes in an archives/records service.

In principle any type of data (textual or numeric, narrative or tabulated) can be handled by an automated system. Therefore computers can be considered as a means of carrying out any of the functions of a records or archives service. A brief survey of these functions may be useful as a check list.

At the start, two approaches are possible. One is to consider the introduction of a total automation system, covering all or many of the main functions of the archives service in an integrated way. The other is to think of introducing a limited system to carry out just one function in a specialist manner. Although the potential of the first is likely to be realised eventually, few archives services have yet attempted it. The risks of overinvestment and overcomplication would be great. At the practical level, the second approach has generally been thought more fruitful, and there have been some notable successes in it.

Input

All computer processing of data starts with the input of information. In the context of archives and records services, input begins with the work done to identify appropriate archive or record materials, to take them in, and bring them under control.

In records management, this area of work would include surveying current records, and devising ways of controlling their movement, including the making of retention schedules and finding ways of ensuring the retirement of semi-current materials. Running a records centre includes control of materials being brought into it, the issue of records to users, and their eventual disposal.

In an archives service, functions may include the fieldwork involved in surveying the materials to be considered for taking in, and building up registers of series. Accessions registration provides a tool for controlling the materials when received.

Processing.

When materials have been brought in, they are put through a further series of processes. Some of these are listed here.

Conservation control or holdings maintenance includes the processes which all materials are put through: fumigation or

cleaning, boxing, allocation of storage locations, labelling the boxes or the documents. If particular items are to be repaired, then identifying these and controlling the progress of the repair could be included.

Administrative control includes the requirement that any particular document can be retrieved and produced for use, and that the storage space available is well used.

Intellectual control goes further than this, and aims at exploiting as much as possible of the information contained in the original materials. The main functions here are constructing finding aids of different kinds. Some of these are structural (they are based upon the provenance and administrative history of the materials), some are based upon subject selections. The finding aids may be at different levels and used for different purposes. A guide to the holdings of the repository gives an overview at (usually) group and series level, whereas the list, inventory or catalogue of a particular group gives a more detailed view of one particular source, going down to item level. All these finding aids need indexes, or some other means of entry into lengthy and complicated text; and they would be improved by cross-references or other methods of bringing different parts of the finding aid system together.

Output.

Output is the product of an information system. If the system is working correctly, the output will suit its purposes and functions.

In the context of an archives service, the principal output is service to users. The management of the searchroom is one form of this. Other aspects are wider user services, and the education of users; one might add the development of a larger circle of users, or the improvement of the supply of information to existing users.

Programme evaluation

There is one additional feature which should be part of any system of management: evaluation. There is no point in running any service unless it is found to be useful: there must be an adequate return for the money invested. This is true of manual systems just as much as for automated ones. There should therefore be some way of regularly testing for the efficiency of the system, and for checking that its output really corresponds to the needs of the user clientele.

III. Systems specification.

Probably the most difficult single part of introducing automation is deciding on and writing the initial systems specification. This is because it has to be done before experience in running any automated system has been gained, so that the archivists or records managers who are doing it have a complex task. They have to analyse the work of their service, set out clearly which processes are to be considered for automation, and match these against the capabilities of an automated system. Yet the best way of assessing system capabilities is by experience.

For this reason, it may be desirable to send archivists or records managers to observe or help with an automated system in another services, just to acquire some basic experience.

Two recent studies exist which may serve as relatively detailed but still general guidelines. These are Kesner (1985) and Philips & Woolgar (1985). Kesner's study is much the more detailed of the two, and discusses all the possible difficulties which might be encountered. It provides a set of matrices (analytical tables in which all the variables and their combinations are listed) which could be used to plot information, and so match requirements against the systems offered. However these matrices are set in a North American (that is, a technologically very sophisticated) frame of reference, and are in some cases very detailed indeed, so that they are not necessarily useful where the range of options is not so wide. In this respect the Philips & Woolgar study, being simpler and limited to a single case, is easier to use.

Nevertheless there is nothing inherently so difficult in the process of systems analysis and evaluation that it cannot be done by a competent archivist or records manager, especially if technical advice is available. Some techniques are helpful, and are briefly discussed below. The possession of these techniques and the experience of having done the analysis will be of great value to any information worker.

Systems analysis

The objective here is to find out what processes are actually being carried out in the service, and what objectives are intended to be reached. Naturally these are facts which any professional ought to know about the work in hand, but traditionally and in a manual context the business of analysis is often not done as a conscious exercise.

As was suggested above, there are three stages: input, processing, and output.

In the input sector, the systems analyst seeks to find out

how the relevant information is collected, put together and prepared for input into the system. Both collecting information and preparing it are likely to present some problems for archivists.

Data capture is the term used to describe all processes of collecting and recording the data which is to be used. It is often done by designing a form on which members of the archives staff can write in appropriate bits of information. Bell & Roper (1975) gives a facsimile of the data capture form used in the Public Record Office in London. A new form is started whenever a consignment of archives arrives in the office. Accessions data is written in by the accessions control section. When the material is listed, a note of this is added by those who do this work. If it is sent for microfilming, this information is added by the photographic section. Location information is added by the repository management section, and so forth until a full entry has been completed. The completed form can then be used to provide the data for entry into the computerised system which produces a printed guide entry.

In smaller archives services, it may not be necessary to set up such an elaborate procedure. All the data needed may be provided by a single staff member, during the course of sorting and listing. Even so, it may be found desirable to design a form which can be used for recording data in a systematic and uniform way. The form would contain spaces for all the details needed, and so would assist completeness as well as uniformity. Unless data entry is to be done at the same time (perhaps by using a terminal at the work site) some sort of written notes will always be needed for the first stage of data capture.

In data entry the information gathered during data capture is brought together and processed into the automated system. Usually this is done by some form of keyboarding. In earlier years the most common method was to use a card puncher to produce a set of machine-readable cards. This method has now been displaced in favour of some form of direct data entry equipment. There are many varieties of this. In one type, the data is transferred to a magnetic tape in a cassette, which can be read by the computer. More commonly today, the data is typed directly into the computer's information store by means of a terminal.

Another approach to data entry is by Optical Character Recognition (OCR), in which a data input machine scans written or typed pages. This technique is especially interesting to archivists, since it offers the possibility of transferring the backlog of written finding aids to a computer-readable form, without necessarily reprocessing the whole lot. Early forms of OCR depended on machines which could only read set arrangements of characters, displayed in set typefaces or typed with a special ribbon. New technologies in this area can read manuscript or non-standard typed material, by converting it into patterns recorded digitally. These new technologies have a long way to go before they are likely to be suitable for everyday use in ar-

chives services. OCR by way of typescripts using standard arrangements of data and approved typefaces does sometimes offer the possibility of a cheap and practical way to process data for entry.

It may be useful at this stage to consider the question of data structure, that is the way in which various elements of data are combined in finding aids. A simple comparison is with bibliographical descriptions created by libraries. Normally each record (the description of one book) is structured into three or more parts: author information, title, and publication information. Each of these parts may be subdivided: for example, publication information might have elements covering publisher, place of publication, date, number of pages, etc. When data is held in such a clearly structured form, it is relatively easy to process it into a computerised database and so produce an automated catalogue.

In the same way, archival descriptions are usually structured as records divided into fields, each of which contains a specific type of information. The description of a series, for example, might contain six fields:

- reference code
- series title
- covering dates
- bulk
- format
- abstract (a free text description of origin and contents).

Each series description, containing entries for these six fields, constitutes a record, and the whole collection of records describing a set of series constitutes a file in a computerised database.

So far there is no difficulty in following the analogy of bibliographical records. The trouble is that archival descriptions have a different structure at different levels, and these different levels have somehow to be combined. For example, a full archival catalogue or guide would have descriptions at group, subgroup, series and item level, each of which would have a different layout. This is one of the main difficulties in automating systems for archival description, and is an important reason why library systems are so often unsuitable for archivists to adopt.

Nevertheless, some archives services have successfully adapted standard bibliographical description formats to archival use. An advantage of this is that these formats (for example the MARC format used for international bibliographical exchanges) are already well defined and can be used in existing systems. Because of this, archives services whose material is very uniform, and can be described mainly at a single level, can consider adapting a library system, or even joining a library network. A good example of suitable material is an archive consisting of the letters of an important individual. In a manual system this sort

of material could perhaps be listed on catalogue cards: the cards can be converted into records in an electronic database, and all the benefits of computerisation can be obtained.

Among these benefits is the possibility of exchanging information between institutions, or even between countries. This kind of exchange is only feasible where the structure of records is either uniform, or at least is of a kind which can be read by the computer systems of the participating institutions. Experimental work is in hand to devise a system of making archival descriptions readable in this way, between systems (for example, the SAF system proposed by Cahoon, 1984). But the best known and most widely used format for exchanging information electronically is the MARC structure for library materials. In cases where this can satisfactorily be used for archival descriptions, and allow them to be assimilated into another database or network, the approach can be of great value. It would particularly be of interest to archivists who were concerned with building up a national register or multi-repository finding aid.

ISO 8211 is relevant to questions concerning the compatibility of the structure of archival descriptions, and their suitability for information exchange.

An alternative to adopting library formats would be to use the formats offered by software packages available locally, and to make these compatible with other systems as far as possible. Information retrieval packages can often be obtained and set up by particular computing services. They generally specify a certain kind of layout and file structure, although they also often allow the users a degree of flexibility to adapt them to their own needs. Incompatibility between systems is usually strongest at the most technical level. Hence it is rarely possible to transfer data from one software (or hardware) system to another, without extra programming work. ISO 8211 is also relevant here.

Once the data is entered, it may be necessary to provide for verification or proof-reading to make sure that the data entered is correct both in substance and in form. After this point, the technical means by which it is processed is not necessarily the concern of the archivists.

The nature and arrangement of the output to be provided by the system is of course very important, and it is necessary to decide precisely what kind of output is wanted before embarking upon extensive data input. In principle one important choice must be made. This is between using the computer system as a quicker and better means to provide traditional output, and using it to provide new forms of output.

An example of a project aimed at traditional output would be a system which streamlines the processes leading to the publication of a manual (hard-copy) finding aid. The Manuscripts Department of the British Library made the decision to use this approach, when they carried out their feasibility study (Hibbins

1982). In this application, the computer is used to produce a printed catalogue uniform with the previous volumes issued in earlier years. Under this scheme the archivists would continue to write their descriptions out on paper (or at least onto input forms). Instead of being collated and typed, these would be processed by microcomputer, and all the intermediate clerical work would be compressed into this. The users would find that the traditional series of printed catalogues, complete with indexes, would continue to appear, only with a smaller time lapse between accessioning the material and the appearance of the volume. Some of the most tedious and expensive of the production processes would be avoided.

New forms of output might include systems which allow users to search a data base held within the computer. In systems of this kind there need not be any hard-copy output. It would of course be possible to combine both old and new approaches, so that a full printed finding aid is produced as well as facilities for searching the data base. The essential point is that the character of the output envisaged does to a large extent determine the form of the data input, and the nature of the processes carried out.

When analysing a system, it is usually thought useful for the analysts to plot their findings in a flow chart, setting out the logical relationships between the different activities. Learning how to construct a flow chart would therefore be a useful start to a systems analysis. Fig. 1 showing the process of archival appraisal, is taken from Gavrel & McDonald (1981,p.13).

The final stages of a systems analysis would include consideration of the effects of a new system on the staff, budget and priorities of the service. Other useful features might be a comparison with other archives/records services elsewhere, and an investigation of the links which might be developed between the archives service and central management services. Lastly, the findings of the analysis should be put into a report, which will specify exactly what is required of a system to achieve the desired objectives.

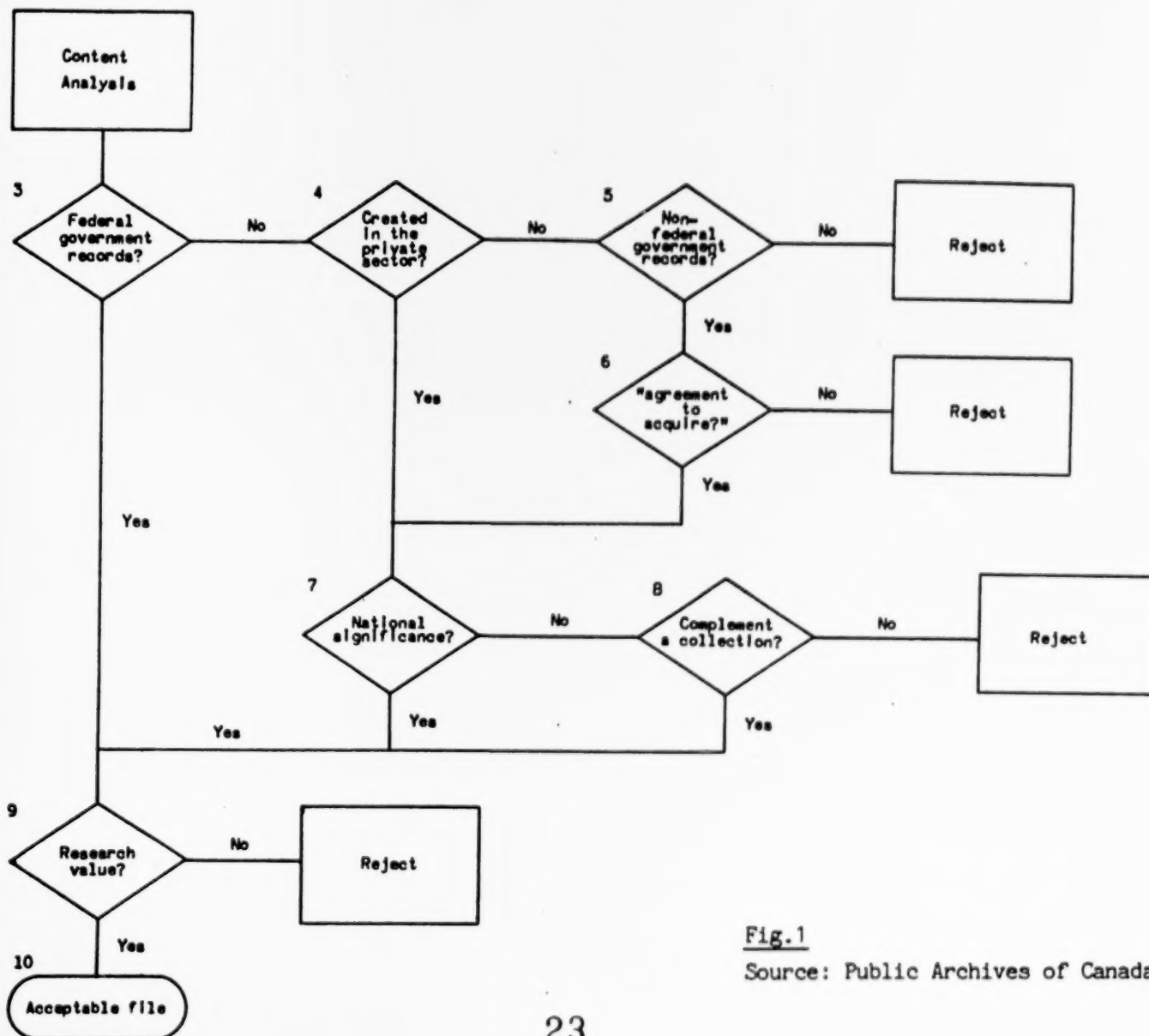


Fig.1

Source: Public Archives of Canada

IV. Examples of specific applications

In this section, a brief outline is given, which will help readers to identify existing computer systems which do relevant work. Further information on any of them can usually be obtained by contacting the service named. The International Council on Archives International Directory of Archives (1975) can be used to find the exact addresses. Published sources are indicated wherever possible.

1. Records management

There is no single model for an ADP approach to records management, since the range of activities involved in the whole field of RM is too wide. At its most extensive, RM covers most aspects of the creation, movement, retrieval, use and disposal of records within an organisation. RM which is concerned with the treatment of current records must clearly take account of automated systems for administration, office or business use. This is a very active field in which there is constant innovation. The best source of up-to-date information is likely to be from firms or organisations which supply equipment to the private sector.

However, in an archival or RM context, Newton (1981) surveys the main effects of the automation of office systems and their effect on RM. It is clear that if the record-creating systems of an organisation are themselves automated, then the corresponding RM systems must be automated in association with them.

The Aktenabgabedatei system of the Bundesarchiv sets out to control the creation, retirement and disposal of the principal records used in the federal government of the German Federal Republic: see Fig.2. Another wide-ranging system is MINISIS-RM, operated by the federal government of Canada (Public Archives of Canada, 1985). However both these organisations are large and complex, and have invested relatively large amounts in their automated systems. For this reason they may not provide easy models for smaller countries or organisations.

For these, perhaps the best model is the records management system of the archives service of the Metropolitan County Council of Tyne and Wear, in Britain. This is called ARMS, and has a fuller description in Cook (1980, pp. 58-71): see Figs.3-4.

ARMS contains two parallel data bases, the retention schedule and the master list. The retention schedule (as is customary) lists all series known to the archives staff, and allocates a retention instruction. The master list contains details of the actual records received in the records centre, using the usual manual transfer lists as data input forms. Cross-referring from

Umsiedlung aus Überbelegten Ländern. - Vorbereitung und Durchführung einer VO									
005242	Band	2	Az: 5308/17	05/	79	1934-	1940	ZWARCH	1985
005243	Band	3	Az: 5308/17	05/	79	1940-	1971	ZWARCH	1985
005322	Verordnung über die Bereitstellung von Durchgangslagern und über die Verteilung der in das Bundesgebiet aufgenommenen deutschen Vertriebenen auf die Länder (Verteilungsverordnung)					1931-	1954	ZWARCH	2005
			Az: 8500	5/	82				
005323	Festsetzung des Verteilungsausschusses für die von den Ländern aufzunehmenden Vertriebenen und Flüchtlinge. - Bestellung von Bundesbeauftragten für die Verteilung					1931-	1958	ZWARCH	2005
			Az: 8500	5/	82				
005328	Verteilung von Flüchtlingen auf die Länder. - Sitzungsprotokolle					1956-	1959	ZWARCH	1985
			Az: 8501	4/	82				
	Bem.: siehe auch Az. 8507								
005376	Verteilung von Flüchtlingen auf die Länder								
	Band	1	Az: 8507	5/	82	1950-	1955	ZWARCH	1985
	Bem.: siehe auch Az. 8501								

Fig.2

Printout of the Findbuch (finding aid) for ministerial records:
Bundesarchiv, FRG.

DEPARTMENT/SECTION: DATE:

THE SCHEDULE BELOW GIVES DETAILS OF THE CLASS NUMBERS ALLOCATED BY THE ARCHIVES DEPARTMENT TO THE CLASSES OF RECORDS PRODUCED BY YOUR DEPARTMENT OR SECTION.

*** THESE CLASS NUMBERS ARE IMPORTANT. ***

IT IS ESSENTIAL THAT, WHEN YOU TRANSFER RECORDS TO THE RECORDS CENTRE OR REQUEST THE PRODUCTION OF RECORDS HELD IN THE CENTRE, YOU GIVE THE CORRECT CLASS NUMBER.

YOU SHOULD DESTROY ALL EARLIER ISSUES OF THIS SCHEDULE.

CLASS NUMBER	DRM	ACTION CODE	RETN. (YRS)	ACCESS	MAIN TITLE	SUB TITLE
AJ0001P	2	21			DISTRICT COUNCIL AGENDAS - GATESHEAD	
AJ0002P	2	21			DISTRICT COUNCIL AGENDAS - NEWCASTLE	
AJ0003P	2	21			DISTRICT COUNCIL AGENDAS - NTH TYNESIDE	
AJ0004P	2	21			DISTRICT COUNCIL AGENDAS - STH TYNESIDE	
AJ0005P	2	21			DISTRICT COUNCIL AGENDAS - SUNDERLAND	
AJ00060	2	01	3		METROPOLITAN CTY AGENDAS - GT MANCHESTER	
AJ00070	2	01	3		METROPOLITAN CTY AGENDAS - MERSEYSIDE	
AJ00080	2	01	3		METROPOLITAN CTY AGENDAS - STH YORKSHIRE	
AJ00090	2	01	3		METROPOLITAN CTY AGENDAS - WEST MIDLANDS	
AJ00100	2	01	3		METROPOLITAN CTY AGENDAS - WST YORKSHIRE	
AJ00110	2	01	5		COUNTY COUNCIL AGENDAS - NORTHUMBERLAND	
AJ00120	2	01	5		COUNTY COUNCIL AGENDAS - DURHAM	
AJ0013P	1	22			DAILY ABSTRACT NEWSPAPER CUTTINGS	
AJ0014P	1	22			WEEKLY REVIEW JOURNAL CUTTINGS	
AJ00150	2	01	3		AMA AGENDAS - ASSOCIATION	

Fig.3 A records retention schedule: ARMS.

DATE 10/10/79 TIME 17.25.41 TYNE AND WEAR COUNTY COUNCIL REPORT RM02 PAGE 22

* * * ARCHIVES DEPARTMENT - RECORDS MANAGEMENT SYSTEM * * *

REVIEW SCHEDULE FOR THE MONTH ENDING 30/09/79

DEPARTMENT/SECTION:

TO:

THE FOLLOWING RECORDS WERE TRANSFERRED BY YOUR DEPARTMENT OR SECTION TO THE RECORDS CENTRE AND ARE NOW DUE FOR REVIEW AS Laid DOWN IN THE COUNTY RECORDS RETENTION SCHEDULE. INFORMATION ON THE NUMBER OF REQUESTS MADE FOR A REVIEW AND THE DATE OF THE LAST REQUEST IS GIVEN BELOW.

WILL YOU INDICATE IN THE DECISION COLUMN (4) WHETHER THE RECORDS SHOULD BE DESTROYED OR RETAINED UNTIL THE NEXT REVIEW. (REVIEWS TAKE PLACE 2, 5, 10 AND 15 YEARS AFTER THE RECORDS REACH THE RECORDS CENTRE.)

PLEASE SIGN AND DATE THIS FORM AND RETURN TO THE RECORDS CENTRE.

SIGNATURE: DATE:

CLASS NUMBER	DEPARTMENTAL FILE NUMBERS/PREFERENCES (FROM)	COVERING DATES (ETO)	COVERING DATES (FROM)	ETO	BY	FORMAT	YRS	NUMBER	REVIEW RECEIPT NUMBER	REQUESTS NO.	DATE	DECISION COLUMN
W20005X 551E			75	1		2	77/0440	0				
W20005X 56452	56456					2	77/0500	0				
W20005X 56457						2	77/0498	0				
W20005X 56458						2	77/0498	0				
W20005X 570C1		74	75	1		2	77/0440	0				
W20005X 570C1		74	76	1		2	77/0440	0				

*** END OF DEPARTMENT/SECTION ***

Fig.4 A monthly return of files for review: ARMS.

the retention schedule to the master list allows any record to be brought up at appropriate periods for review, for destruction or for transfer to the archives.

The system provides as output a number of reports. Some of these are used for validation and checking, while some can be used as a link with user departments. The monthly list of records received, for example, arranged by departments, can be used as a receipt. Another monthly report lists records which have been issued to departments for reference, but not returned by the agreed date. A monthly report brings up documents for review, and those which are to be disposed of can be notified to departments in another periodical report. Some reports are of administrative value to the archives service, such as a regular report on vacant locations in the records centre, a yearly list of archived records, and a yearly list of the rate of reference to each records series.

This system has been in use since 1978 and has proved itself practical. It is a passive RM system in that it seeks to control records only from the point of transfer to the records centre (and not from the point of creation). Originally it was a batch system used off-line, but conversion to online working has been undertaken. It does not at present provide a facility for including or linking in descriptions of documents transferred to the archives. Nevertheless it allows the service to run an RM scheme for a large organisation (the government of an extended city area) with a staff of two clerks and part of the time of a supervising archivist.

ARMS is a system using a central mainframe computer, based on software specially developed. Other mainframe RM applications have successfully adapted standard software packages. Most of the principal information retrieval packages have been used in this way, particularly STAIRS, ASSASSIN and CAIRS. A less well known package, a relational database management system, SQL/DS has been used at Liverpool University for RM purposes (see figs.5-7). These mainframe packages, however, will be mainly of interest to those who are committed to the use of a central computing service.

RM applications based on microcomputers have also been developed. In the private sector, Pilkington Bros plc, an international plate-glass manufacturer, has adopted a standard package for stock control of records in the records centre. This is dBase3, used on an IBM PC/XT microcomputer. A parallel system is at the National Girobank (a post-office banking system) which uses the package Cardbox Plus on an Apricot microcomputer. Other RM applications noted use the software package Delta, on a variety of machines, particularly those which emulate IBM-PCs. An example is the system for control of pensions records at the National Archives of Malaysia.

A survey in 1983 suggested that systems for the control of records from the point of creation could be found in some large

SELECT * FROM CONSIGNMENTS WHERE DEPTCODE='VCS'

DEPTCODE	CONSIGNMENT	MONTH_REC'D	YEAR_REC'D	BULK	FIRST_BOX
VCS	15	1	1985	1	8467
VCS	19	3	1985	3	8429
VCS	35	9	1985	1	9188
VCS	38	9	1985	1	9192

ARI8501 SQL SELECT PROCESSING SUCCESSFUL: ROWCOUNT=4

Fig.5

List of consignments received in a records centre: Liverpool University.

10/23/85

DEPTCODE	CLASSNO	TITLE	ACTIONCAT	RETENTION
DPT	401	corres files	r	10 years
DPT	402	departmental order books	d	6 years
DPT	403	external bodies papers of	r	10 years
DPT	404	petty cash books	d	6 years
DPT	405	invoices	d	6 years
DPT	501	staff memos private files	r	10 years
DPT	601	student records formal or informal	r	10 years
DPT	901	exam scripts	d	1 year

Fig.6

A class retention schedule: Liverpool University.

10/23/85

ACTIONYR	ACTIONMTH	DEPTCODE	TITLE	LOCATION
-----	-----	-----	-----	-----
1986	12	VCS	UGC main cte	9192
1986	12	VCS	Social studies cte	9192
1986	12	VCS	Visitations Dental sub-cte	9192
1986	12	VCS	UGC Grants approval	9192
1986	12	VCS	UGC Clinical salaries	9192
1986	12	VCS	Medical sub-cte	9192
1986	12	VCS	Mathematical sciences sub-cte	9192
1986	12	VCS	Dental sub-cte	9192
1986	12	VCS	Medical sub-cte	9192
1986	12	VCS	Agriculture/Veterinary Science sub-<	9192
1986	12	VCS	CVCP papers General purposes cte	9192
1988	12	VCS	UGC corres/statistics; UGC student <	8429
1989	12	VCS	CPME	8467
1989	12	VCS	CVCP: EEC report on methods of asse<	8455
1990	12	VCS	Committee on Hardship meetings	9188
1990	12	VCS	Hardship fund internal corres,annua<	9188
1990	12	VCS	Vice-Chancellor's discretionary fund<	9183
1990	12	VCS	Hardship fund applications C-H	9153
1990	12	VCS	Charles Brotherton trust	9136
1990	12	VCS	Holt education trust Meetings	9188
1994	12	VCS	Panel on EEC directives; architects<	8448
1994	12	VCS	Advisory panel on dental training; <	8448
1994	12	VCS	Working group on university profess<	8448
1994	12	VCS	EEC advisory committee on medical t<	8448
1994	12	VCS	Wirral postgraduate centre, 10th an<	8448
1994	12	VCS	European directives- doctors; draft<	8448

Fig.7

A schedule of records due for destruction: Liverpool University.

business firms. An example is British Petroleum in London. Their system is also based on the principle of stock control, in that it sets out to provide a record of the history of each document generated by the administration, from origin to disposal. The purpose of this is to satisfy legal requirements as well as to give efficient management of the materials. In addition, a powerful information retrieval facility allows reference to documents by means of remote terminals scattered throughout the firm's worksites (Bartle & Cook, 1983, p.24).

2. Accessions registration

All records and archives services keep an accessions register, and the international survey done by the ICA Automation Committee in 1985 shows that it is a popular choice as a point for introducing ADP. The main function of an accessions register is to preserve permanently the record of the provenance of a group of archives received on transfer. While it is doing this, the register can be used to carry out other functions and to serve as a starting point for an instrument of administrative control. The data can be used, for example, to provide a receipt for the transferring body, or originator; to notify a national register of the existence of the archive; and to give a checklist for the completion of administrative tasks and processes within the service.

It is at this point that archives services resemble museums quite closely, and it is therefore not surprising that automated systems based upon accessions registers have tended to originate in museums. The best-known and most elaborate system is probably that developed in the archives departments of the Smithsonian Institution in Washington DC. Their system SELGEM was developed in the 1970's, and was used to print catalogues. It is now being transformed into a more flexible system known as SIBIS, which will extend into overall collection management. For this, the construction of accessions registers is an excellent starting point.

3. Construction of finding aids.

Most automated systems in archives are directed to the construction of finding aids of one sort or another. Probably most are intended to produce hard-copy guides, or catalogues, with indexes, and in the following the various types are dealt with one by one.

(a) Word-processing and clerical operations.

Word-processors are now widely used in archives services, as they are in any kind of office. Where the infrastructure exists for introducing them, it can be firmly stated that typewriters are obsolete. Archives work is particularly suitable for word-processing, and it should be easy to make out the case for investment in the equipment, which is not necessarily expensive, and which will not necessarily cause much upheaval in office organisation.

A word-processor may be either a general-purpose micro-computer used with suitable software, or it may be specially designed hardware. As time passes, the gap between these two categories is becoming less easy to define. Word-processors may also be used to process data being input to a computer, and to format data being output from one.

Almost any microcomputer, however cheap and simple, can be used for writing text, and has been provided by its manufacturer with word-processing software. For use in an archives office context, however, there are several technical requirements which should be satisfied.

1. The keyboard should be usable by a trained typist.
2. The software should have a command language easily comprehensible by clerical staff, and should be reasonably practical. It should probably have automatic underlining, for example.
3. System software and data storage should be on disk.
4. Data storage capacity should be adequate for holding large files (however this is normal nowadays).
5. There should be access to a good quality printer, which however does not necessarily have to be held in the archives office itself: common facilities can be used.
6. Consideration should be given to
 - (a) including graphics (especially the ability to include graphs and diagrams in reports);
 - (b) developing compatible systems within the various branches of the organisation: networking office communications is a real possibility.

The great virtue of word-processors in an archival context is that they can hold long files, for example of archival descriptions, in a form which can be amended and manipulated. These files can be retained on disk and can be used in various ways. They can be formatted for output in printed form, either in whole or in part, on demand. Amendments and additions can be added easily, and do not involve any retyping or proof-reading of the unamended parts. Sections of the list can be selected and output in different orders or in different contexts. There is usually a facility for automatic searching for keywords, which can also be used to correct errors which run through the whole text. If there is a network, files can be accessed from several points, and if there is system compatibility (there rarely is, however)

it is possible to transmit data over telephone links or at least on disk.

It is probable that word-processors are in the middle of a period of rapid change and development. This has involved a massive reduction in purchase price. Their advantages over typewriters are so great that it would require serious reasons to delay the introduction of a system.

An example of the use of word-processors for archival management is provided by Routledge Associates Ltd, which is described more fully in Bartle & Cook (1983, p.45). In this application a relatively large dedicated word-processing system is used (a Philips 5003). This has a satellite terminal, which can be taken to wherever the work is being done - data can then be typed in from that point. It can also provide machine-generated indexes. In practice the latter facility has been found less useful than the system's power to search for keywords online, but it has been used to print indexes to copies of lists held in libraries and other reference points.

(b) Multi-repository guides.

Automation has sometimes been introduced because it seemed to offer a good way of constructing multi-repository guides. Most countries perceive a need for publishing broad guides to source material held in various repositories, and some have set up national registers. The publication of the National Union Catalog of Manuscript Collections in the USA broke new ground in setting standards of compatibility for group(collection) level descriptions, as well as for the technology required to process them. That NUCMC today seems rather old-fashioned underlines the potential for developing online multi-repository guides, in the form of networks. These are dealt with in the next section.

An advantage which a project for a multi-repository guide might have is that it would demand a plan for reasonably uniform sets of descriptions at a set level - probably the group or collection level. This avoids the problems of listing at several levels of description, and also the need to disturb the internal arrangements of participating services. It is possible that a new project of this kind would attract investment under a national information development policy, and it would certainly introduce or strengthen co-operative working between information services.

Some of the difficulties involved in establishing standards for multi-repository guides are illustrated in the evaluation of the Midwest State Archives Guide Project (Evans et al, 1982).

Two useful examples are provided by archivists in the Netherlands (Van Driel, 1984). A plan for publishing a general guide to the holdings of all Dutch repositories was adopted in 1979: this was to use traditional publishing methods. The problems of updating and maintaining all this information were appreciated, and research into using an automated data base system was begun in 1983. This would include the possibility of providing users with select printouts (instead of referring to whole volumes), and of linking with the Dutch library network PICA.

A second project in the Netherlands covered archival material held in private hands. This was the system RAPIDE, developed and operated by the Catholic Documentation Centre at the Catholic University of Nijmegen, which lists all documentary material dealing with Catholic life during the last two centuries. The national archives of Quebec also undertakes a survey of materials held in the province.

(c) Networks.

Implicit in projects for multi-repository guides is the possibility of a network: a system in which the finding aids of a number of linked repositories are made available by automated means. Such systems have long been available for bibliographical or scientific materials on both national and international le-

vels. Archivists have been slow to develop this aspect of their work, not only because of the inherent difficulty of standardising unique and varied materials but also because the need for very rapid access at remote sites was less easy to demonstrate in their case.

However a number of online networks are now in use, and some reference to them should be made. The most highly organised of them are to be found in the USA. First to be set up was the SPINDEX users' network, developed during the 1970's, and using a software package developed in the Library of Congress and at the National Archives (Hickerson, 1981, p.5). In terms of innovation, this has now been replaced by two big library-based networks, RLIN and OCLC, together with a number of smaller ones such as BRISC, ARCHON3 (Kesner, 1982-3) and MARS (Kesner & Hurst, 1980). The first of these is one of the group which has developed an archival adaptation of RLIN (Reed, 1985).

Being library-oriented, these networks assume library-compatible data. Librarians are fortunate in possessing a system for the standardisation and exchange of bibliographical data: this is known as MARC, and (in various forms) is in use internationally. Despite the difficulties in assimilating archival descriptions to bibliographic ones, an adaptation of MARC which is usable for archives has been written, and is known as MARC AMC. The library orientation may reduce the value of these pioneering examples for general archives services, but the experiment illustrates the value of drawing on the resources and experience of the major information systems. In most countries the development of archival networks will depend on library or information networks being developed first.

It is possible, however, to have networks which do not demand a bibliographical format. One now beginning to operate in Britain uses the technical facilities of JANET (Joint Academic Network), a general-purpose linkage system between universities and research institutes. The University of Southampton has now made available a full description of the papers of the first Duke of Wellington, using the software package STATUS. Users therefore must know the command language of this package, but otherwise the only requirement is access to a terminal which is part of the network. Similar developments would be possible, in principle, by means of one or other of the major electronic communications systems which exist or are being planned.

It is possible that the development of general-purpose computer networks will in the long run make it unnecessary to develop either specialist archival exchange systems or adapt archival data to library formats.

(d) Single-repository guides.

Most repositories publish a guide to their contents, surveying their holdings briefly at group/series level, and provi-

ding an explanatory introduction and an index. As with the multi-repository guides, bringing in a computer can transform the character of the traditional printed guide, by making it possible to amend and update the information, and by allowing new forms of access by users. Problems of co-ordination are less than with multi-repository guides, for standards of compatibility need only be set within the repository. On the other hand, it would be necessary to change the methods of work within the service, and this in turn would need both a careful systems analysis and the full co-operation of experienced staff.

The city archives at the Hague has such a project (Van Driel, 1984, p.44). Several institutions in the USA have achieved successful output: these include the Smithsonian Institution, and the University of Illinois, but there are many other American examples (McCrank, 1982).

These successful examples are mainly of descriptions at group/collection level. The problems of reducing archival descriptions at different levels to a single format have proved more of an obstacle to automating general guides than might have been foreseen. The British Public Record Office introduced an automated system for producing a guide as long ago as 1974 (Bell & Roper, 1975), but has not yet produced a hard-copy volume as a result. Their system PROSPEC is used to produce series-level descriptions inhouse, but cannot, within the system, link them to the administrative histories required for group level descriptions.

The PROSPEC system already referred to is one which has now been in successful operation for many years, and consequently demonstrates the defects of a pioneer. It has been essentially a batch mode system, and is limited to providing uniformly formatted series level descriptions for use at different points within the service. Published volumes of the repository's guide will eventually be one outcome, but for a long time all series level descriptions have been produced for internal use.

The Archives Office of Tasmania (Australia) is developing a system which will provide agency registration, administrative histories, series descriptions and summary guide entries. This system is called ARCLIST, and is an adaptation of a library package ADLIB, which is available locally.

(e) Item-level listing.

Most of the computer applications which have been developed within particular repositories can be classified as item-listing systems. The reason is twofold: it is much easier to adapt library or stock-control systems when all the material is treated at one level; and the computer's ability to provide subject access points is most easily exploited through these systems.

The National Maritime Museum in London began using automated methods in 1978, to create a list and index of documents (mainly letters) relating to Admiral Lord Nelson (Bartle & Cook, 1983, p.41). This system illustrates many of the advantages offered by the computer. Input data is structured into seven fields: date, place, ship mentioned, recipient's name, type of document, size of document and location. Since the resulting data base can be sorted by any of these fields, many outputs were produced:

- a list in reference number order;
- a list in date order;
- a place-name index;
- a list by names of recipient;
- a list of letters in order of place of writing;
- a handlist of document types.

In this way a single batch of input data can be used to provide a large number of different arrangements of output data.

There are many other examples of this approach, using software already available through library or museum sources, or using business stock control packages. The British Antarctic Survey (Bartle & Cook, 1983, p.21) has adapted the cataloguing cards designed by the Museum Documentation Association as input data forms, and this has allowed them to use two different software packages on the same data, translating the information from one system to another. Another British example is the system produced at St John's College, Cambridge for listing the early archives of the college (Underwood, 1979).

The BAS approach is one which can be readily emulated in most smaller archives services, especially since the data input cards can be processed into almost any information retrieval or database system. There are problems with the levels of description, but these can be partly or even wholly overcome by using cards for group and series level descriptions, as well as for item descriptions. The cards were designed with assistance from the Museum Documentation Association. One of the input cards has been reproduced in Fig.8.

The system KATALOG of the National Archives of Norway is for listing archival material at series and item level, and was developed within the service.

(f) Indexing.

This is the application which, in various forms, has tended mainly to attract the attention of archivists, at least in the early stages of automation. The computer's ability to identify, sort and retrieve keywords made it seem likely that the old problem of providing subject access to archives which were stored and listed in structural order might be solvable without too much labour. Also, many computer projects were initially conceived as information retrieval projects, directly associated with user groups or with research work going on.

There are several different categories of indexing systems.

Perhaps the most popular type is one for the construction of genealogical indexes. There are many examples. The city archives of Amsterdam is indexing registers of baptisms (Van Driel, 1984, p.46). Indexes to wills exist at the Lichfield (Alcock, 1982) and West Sussex Record Offices (Bartle & Cook, 1984, p.52), among others. The work of the Historical Department of the Church of Latter-Day Saints, at Salt Lake City, Utah, USA, has included many projects for the indexing of individual names from large record sources.

There are many other indexing projects. One of the most important is that of the Belgian State Archives (Pieyns, 1980): see Fig.9. This project provides a unified name and subject index to the very large range of published lists and guides to archival materials in Belgium. Many difficulties of non-standard terminology and index layout were encountered, and the system could only be developed in association with an analysis of indexing vocabularies. On the other hand, the multiplicity and bulk of the sources to be indexed were such that a computerised approach was seen as necessary - no other way of tackling such a large project could have been feasible.

Incoming correspondence is indexed in a network of municipal archives in the Netherlands (den Teuling, 1983). The archives services of Israel have devoted research to the generation of automatic indexes, which include some using Hebrew and Arabic characters (Arad, 1981).

The popularity of indexes will no doubt be reduced by the extension of online databases and facilities for searching text. Even so, they will continue to be useful for certain purposes, such as the publication of finding aids for remote use, or for local users with a low level of technological expertise.

4. User services

(a) Retrieval of archival items from store and producing them in the searchroom.

As with the issue of documents from records centres, it has been found that it is usually not practicable to use library software for this. Library systems are based upon the premise that both document and user can be identified in a machine-readable way, by using magnetic tags and reader's ticket. In an archival context the tasks are not similar: items have to be identified in a box on the shelf, access and other restrictions are checked, the document is produced within the repository, and replaced (most often) the same day. Where issue controls are automated, it is often possible to add the facility of making out lists of records overdue for return.

Card of	Institution N.E.R.C.: BRITISH ANTARCTIC SURVEY		Archive Code ES3/649/4.21/1.2	
PROVENANCE	Division	Section	Record Identity	
	Compiler (of base map) Geologist: Jardine, D. (author of additions)			Place of execution
	Date/s (of base map) Mar 1950		Date/s (of additions)	
SUBJECT DESCRIPTION	Map type Fairdrawn map	Area South Shetland Islands <King George Island>		B.A.S. Geol. Area Code G
	Subject Geology	Title King George Island. Map shows distribution of station numbers		
	Scale Code D 1:200,000	Series	Sheet name/no. 2 (of 5)	Edition
	Publisher/printer		Place	
	Additional information Geological stations and place-names, official and unofficial IMW No. SP 21-22/9			
	Key/no Key			
BAS M1	MAP INDEX CARD		Edition 2	Dec. 1981 Printed by NERC Reprographic Services

REFERENCES	Associated Documents AD6/2G/1949/G (map 2 in report)		
	Publications	reference only/quotation	In part/complete altered/unaltered
CONSERVATION	Author: date: title: journal/publisher: vol: details		
	Physical format Map on blue waxed linen, 430 x 240 mm (neat lines). Text: ms (black ink)		
	Condition	Conservator	To From
	Work done		
MANAGEMENT	Transfer to Archives 26 July 1984	Accession & Process Record 1984/45	Access Code BAS
	Location	Record Transfer List ES 74/1	Disposal Code P
	(Additional to contents) General Cross ref.		Particular

Fig.8

A structured data input card (front and back): British Antarctic Survey.

26 (a)

Fig.9

A section of the index: Archives Générales du Royaume, Belgique.

ABEELE - ABRACHART

CLAUS VAN DEN	ABHL
INV. 386 : REG. 91	
FAMILLE VAN DEN	
INV. 352 : 9,N.	
GILLIS VAN DEN	ABIC
INV. 386 : O. 169,REG. 62	
JAN VAN DEN	
INV. 443 : P. 25,O. 87	
KATELINE VAN DEN,ZUSTER EN OVERSTE VAN HET HOSPITAAL TE AALST	ABL
INV. 386 : REG. 51,71	
MARIE VAN DEN,EP. ANTOINE VAN WISSEKERCKE	
INV. 221 : 91	ABL
PIETER VAN DEN	
INV. 258 : 1664	
ABEILLE	ABL
L',REVUE PEDAGOGIQUE	
INV. 421 : N.106	
ABEL	ABL
A.	
INV. 353 : P. 248 N. 3	
	ABOI
ABELGHEM	
ZIE AVELGEM	
ABERCROMBIE	
R.,DIPLOMATE ANGLAIS	
INV. 162 : 14	
ABERDEEN	
G.-P.-G.,COMTE D',HOMME D'ETAT ANGLAIS,AMBASSADEUR A VIENNE	
INV. 162 : 78,91,137	
ABERDEEN-TEMAIR	
INV. 345 : 24	
	ABO
ABETOULE	
JEAN	
INV. 227 : 6,13	
JEAN,FILS DE JEAN	ABO
INV. 227 : 6	
ABETZ	
O.,AMBASSADEUR TE VICHY	
INV. 467 : 11,47	
	ABC
ABHOOZ	
CHARBONNAGE D',A HERSTAL	
INV. D38 : 162	
SOCIETE CHARBONNIERE D',VOIR SOCIETE CHARBONNIERE D'ABHOOZ	ABP

The system developed by the Public Record Office has proved workable, has improved the flow of records produced for users, and has been labour-saving within this large repository (Wilkinson, 1982-3). Known as PROMPT, this system demands that users learn to type out their requirements themselves on a terminal placed in the reference area. Their reader's ticket number identifies them, and the system checks on whether the document requested is open to them (as far as access restrictions are concerned) and not already issued either to another user or to the repair or photographic units. The document is then retrieved manually. The system automatically compiles statistics on series requested and the category of user.

Some repositories today are introducing bar codes (similar to those printed on the packets in a grocery store) as a means of identifying documents or their containers. Bar codes are simply numerical or alpha-numerical reference numbers, which are shown as a series of lines of varying thickness. They can be read by a portable electronic reader, and the bar code can be used to record and find storage spaces, or to identify archival items without writing out long references or descriptions. In other cases, the system prints out box labels carrying location codes: this is done in the Norwegian system KATALOG.

In smaller repositories, automation of the whole process is probably not viable, but if there are a number of storage areas, and materials are divided between them, an automatically generated location index may be valuable. Examples of this application can be seen at the Strathclyde Regional Archives in Scotland (Strathclyde, 1984) and at the Durham Record Office in England (Bartle & Cook, 1983, p.29).

(b) Online search by staff.

Up to the present, most computer projects within archives and records services have operated offline: they have been directed towards creating printed or other hard-copy finding aids, and these have been the tools used by staff and clients alike. The logic of automation is undoubtedly that in future systems will operate online, by a direct dialogue between the user and the computer, without the use of paper-based finding aids. Most automated systems being developed now, and some of the older ones, use this principle.

Since some degree of training is needed to operate the terminals, systems tend to begin by limiting access to members of staff, who therefore act as intermediaries between external users and the archival materials. An example of this can be seen at the Modern Records Centre at Warwick University (Bartle & Cook, 1983, p. 50). Here the archival descriptions are held in a computerised data base, and the system has facilities for searching. The archives staff use these to predict questions often asked for by users. They run these as searches, and print out

the results as hard-copy finding aids. In records management, the same method is used by Liverpool University Archives Unit. It must be admitted that the approach is an intermediate one, destined to be replaced by full online access as users become more skilled. Nevertheless it is capable of improving the performance of services which are responsible for producing information rapidly for users.

(c) Online search by users.

Although predicted for many years, this method of access has not yet spread beyond a very few of the most advanced archives services, mainly those large American libraries which are members of networks; or, of course, in machine-readable data archives services. The problem is that online searches demand skill and experience to manage well. The searcher must know the command language of the system, must be able to formulate a search request in terms which conform to the words used in the database, and must be able to interpret the significance of a search report. A negative report may be the result of a misuse of search conditions (using "and" instead of "or", for example), a wrong file specification, the use of a synonym of a search keyword, or failure to follow up a broad search request by a narrower one.

A logical extension of user search facilities is remote access, the user employing computer linkages over distance. In a fully developed network, of course, it will no longer be necessary for users to attend at the archives itself, except when they need to consult the original documents.

It is clear that training in searching strategies is needed before any system relying on interactive searches can be installed. This training must be provided for staff as much as for other users. An additional feature of any system which is to be used as part of a network, or to give remote access, is an adequate 'help' facility. This is a display of useful practical explanation and instructions which appears on the screen when the command "help" (or some equivalent) is typed by a user. Help displays should be associated with every level of description, or every aspect of the system. Although most manufacturers now provide help systems with both software and hardware, making the instructions specific to the users' situation usually demands some extra local programming.

The techniques, problems and terminology of online searching in an archival context are discussed in Cook (1986, pp. 139-158).

(d) Content processing.

A large number of archives services have always seen the computer as primarily an aid to exploiting the historical or research information held in the archives, rather than as a means

Fig. 10
Statistics on the state of work done on each archive group:
Bundesarchiv, FRG.

Bestände im Bundesarchiv-Zwischenarchiv St. Augustin

Zugang - Bewertung - Abgang

seit 1965

aufgestellt nach Datensätzen am 31. CS. 1984

X	Bestand	X	Zugang	XX	Aufbew.	X	Gesamt	X	Archivwürdig	X	Kassabel	X	Abgabe	XX	Iststand
X		X		XX	Frist	X	Bewertg.	X	Frist	X	Frist	X	an	XX	
X		X		XX	abgel.	X		X	abgel.	X	läuft	X	BArch	XX	
X	B 102 BMVI	X	212177	XX	94783	X	61848	X	9677	X	2797	X	39198	XX	169128
X	B 106 BMZ	X	99614	XX	33542	X	35098	X	2007	X	4117	X	14994	XX	82523
X	B 109 BMV	X	62781	XX	18498	X	0	X	0	X	0	X	0	XX	62781
X	B 115 BMScha	X	6193	XX	2203	X	2	X	1	X	1	X	0	XX	6193
X	B 116 BML	X	57204	XX	19433	X	2196	X	432	X	152	X	1051	XX	53317
X	B 122 BPPA	X	5168	XX	1245	X	0	X	0	X	0	X	0	XX	5161
X	B 125 BMF	X	64859	XX	22024	X	689	X	313	X	30	X	277	XX	64582
X	B 134 BNBau	X	15122	XX	7721	X	13207	X	951	X	1748	X	5014	XX	10108
X	B 137 BMZ	X	6511	XX	3775	X	4505	X	1043	X	1093	X	1633	XX	4878
X	B 138 BMZW	X	10291	XX	4108	X	5725	X	862	X	945	X	1703	XX	8588
X	B 141 BMJ	X	46756	XX	10267	X	1950	X	66	X	510	X	281	XX	46475
X	B 142 BMSpa	X	7366	XX	3349	X	0	X	0	X	0	X	0	XX	7366
X	B 147 BPA	X	37878	XX	17485	X	0	X	0	X	0	X	0	XX	37878
X	B 148 BMKaps	X	3454	XX	2357	X	118	X	118	X	0	X	0	XX	3454
X	B 149 BPA	X	44680	XX	16875	X	5697	X	7	X	1	X	5041	XX	39038
X	B 150 BMVe	X	8823	XX	6447	X	8821	X	1586	X	289	X	4861	XX	3962
X	B 153 BMFa	X	3897	XX	2966	X	3706	X	460	X	118	X	2316	XX	1521
X	B 157 BMScha	X	7235	XX	2398	X	0	X	0	X	0	X	0	XX	7235
X	B 159 BMJFG	X	15971	XX	4803	X	6612	X	201	X	390	X	2331	XX	13640
X	B 196 BMFT	X	7749	XX	888	X	0	X	0	X	0	X	0	XX	7749
X	B 213 BMZ	X	4148	XX	1102	X	0	X	0	X	0	X	0	XX	4148
X		X	727277	XX	276269	X	150174	X	17724	X	12211	X	78700	XX	639785

ABELSHAUSER, WERNER	AZ.: 9911/ABELSHAUSER
WIRTSCHAFTLICHE ENTWICKLUNG DER BRITISCH-AMERIKANISCHEN BESATZUNGSGE- BIETE	
71 BARCH	•05307••A I 6 06 ••0 I C 20-30-
ABELSHAUSER, WERNER	AZ.: 9911/ABELSHAUSER
WACHSTUMS- UND VERTEILUNGSEFFEKT DER GROSSEN INFLATION	
73 BARCH	•01927••A I 4 05 01••
ABENDROTH, ARNO	AZ.: 6999/ABENDROTH
DIE ZERSTÖRUNG BERLINS	
72 BARCH-MARCH	•05723••A II 7 ••
ABENDROTH, HANS H., DR.	AZ.: 9911/ABENDROTH
DIE DEUTSCH-SPANISCHEN BEZIEHUNGEN IN SPANNUNGSFELD DER EUROPÄISCHEN INTERESSENPOLITIK 1936 - 1939	
71 BARCH	•03583••A I 5 05 07••
ABENDROTH, HANS H., DR.	AZ.: 6999/ABENDROTH
DIE DEUTSCH-SPANISCHEN BEZIEHUNGEN IN SPANNUNGSFELD DER EUROPÄISCHEN INTERESSENPOLITIK 1936-1939	
71 BARCH-MARCH	•03584••A I 5 05 07••
ABENDROTH, HANS H., DR.	AZ.: 6999/ABENDROTH
FRANCO ZWISCHEN DEN BLOECKEN IM ZWEITEN WELTKRIEG	
72 BARCH-MARCH	•06375••B ••
ABENDROTH, HANS H., DR.	AZ.: 9911/ABENDROTH
FRANCO ZWISCHEN DEN BLOECKEN IM ZWEITEN WELTKRIEG	
72 BARCH	•06376••B ••
ABENDROTH, LISA, DR.	AZ.: 311
PETITIONEN AN DIE DEUTSCHE NATIONALVERSAMBLUNG IN DER PAULSKIRCHE	
73 BARCH-AST FFM	•00082••A I 2 01 ••
ABERT, HANS-JUERGEN	AZ.: 9911/ABERT
LUEBECKER WERFT- UND REEDEREIGESCHICHTE	
69 BARCH	•05426••A II 2 ••
ABERT, HANS-JUERGEN	AZ.: 6999/ABERT
KRIEGSNEUBAUTEN DER HANDELSMARINE	
72 BARCH-MARCH	•01140••A I 3 08 01••
ABLEITINGER, ALFRED, DR.	AZ.: 97160/ESTERREICH/102
OESTERREICHISCH-DEUTSCHE BEZIEHUNGEN 1900 - 1914	
67 BARCH	•00585••A I 3 03 02••
ABMEIER, HANS-LUDWIG, DR.	AZ.: 9911/ABMEIER
BIOGRAPHIE PRAELAT CARL ULITZKA	
76 BARCH	•05794••A III ••
ABOS-PADILLA, RICARDO	AZ.: 6992/ABOS-PADILLA
DIE BEZIEHUNGEN ZWISCHEN CHILE UND DEUTSCHLAND 1870 - 1891	
71 BARCH-MARCH	•00763••A I 3 03 07••
ABOS-PADILLA, RICARDO	AZ.: 6992/ABOS-PADILLA
DIE BEZIEHUNGEN ZWISCHEN CHILE UND DEUTSCHLAND 1870 - 1891	
72 BARCH-MARCH	•00764••A I 3 03 07••

Fig.11

List of researchers and their subject of enquiry: Bundesarchiv,
Federal Republic of Germany.

of controlling the management processes in the service. This number includes nearly all the major archives services of Europe. The pioneers of this approach frequently used the availability of computers to begin the exploitation of difficult archives series which had remained underused.

Probably the most distinguished record in this field is held by the State Archives of Italy. There are at least seven important historical projects in progress there (Mariani-Rinaldi, 1981). An interesting, and internationally important, project is the Patriziato Veneto, which creates a series of data bases containing information from demographic, political and administrative sources in Venice in order to give access to specific data and also lead to a broad understanding of many aspects of the Venetian state from the 16th century to its fall in the Revolutionary period (Crescenzi, 1981; ibid, 1982-3).

Any system aimed at substantially improving access to little-known or underused archives groups would result in a rapid development of an area of historical studies. This would be true whether or not the project was computer-based. Examples of automated systems which have had this effect of boosting research should include some which have extended intellectual control over materials of technically distinctive forms. The Hauptstaatsarchiv Dusseldorf has a project for the description of an audio-visual collection which may be compared with the French system ARCADE covering the state picture collection. Using the general information retrieval package called MISTRAL, this project produces finding aids which identify artists, the subject of their work, and the location of the pictures (Cloulas, 1979). The result is a major tool for an aspect of cultural and political history over two centuries.

The government of Tunisia has carried out a project for microfilming archival sources relative to their country but held in France, and has designed a system which will convert this material to a central data base for Tunisian historical studies (Muller & Strohl, 1984). The Canadian package MINISIS was used. It was found that the foreignness of the cultural milieu in which the archives were written has much increased the difficulty of constructing a thesaurus to control the index language, and has also posed problems of user education.

Archivists have often found that the interface between the administration and the exploitation of archival materials is a useful point to begin programmes of automation. The results are likely to be interesting, and lead to public comment. Important user groups are involved, who may be able to bring in new sources of funding. At the same time, the introduction of automation, while bringing in new skills and experience, may not necessarily disrupt traditional methods of managing the service. The role of the archives as an active centre of research is reinforced. These considerations may well outweigh the contrary thought, that there is a clear distinction between the management of archives services and the use made of the materials by clients.

5. Automation in support of the management of an archives or records service.

(a) Control of movement of archives within the repository.

The Public Record Office system PROMPT (see above) controls materials delivered to the searchroom but also to other parts of the building, or their external loan. The Public Archives of Canada's system for passing records from currency into final disposal includes processing for the archives. On a smaller scale, several American organisations have followed the same path. These include Illinois University, and the States of Wisconsin and Kentucky, among others.

The Public Record Office of Victoria (Australia) has a system in the planning stage, which will identify permanent and temporary holdings, give information on repository capacity and stocktaking, and will log requests, issues and returns.

A number of archives services use their computer programmes to control the conservation of their materials, or their passage into and out of the repair unit, though this appears not be common outside the USA and Canada: see Fig.10. One of these is the Archives and Oral History Department of Singapore, which also includes a program for titling microfiche and aperture cards.

(b) Registration of users.

The Spanish State Archives and the Bundesarchiv have undertaken an analytical index of researchers who are users of the archives. This provides a categorisation of these users which is not only useful as a directory, but gives an overview into new directions in research, and the various source materials used (Cortes Alonso, 1979): see Fig.11.

A less ambitious but practical version of user control, managed by means of a microcomputer, is run by the Dyfed Record Office, in Wales. This lists users' names and addresses, with a brief profile of interests. Newsletters and information can then be despatched selectively.

Archives services do not normally make a charge to their users for services offered (except in the case of machine-readable data archives services). Where this is done, there will be a need for accounting procedures. The Archives Office of New South Wales (Australia) has a system for charging services to clients (invoicing, keeping accounts and compiling statistics on income).

(c) Office systems.

Archivists have not rushed to adapt computers for the management of their own organisations. It is probably not common for an archives service to be administratively responsible for its own financing and personnel management, these services usually being done by the employing agency. The Public Archives of Canada, a very large organisation in its own right, has a system for automated office applications and administrative systems covering financial, personnel and inventory (furniture and equipment) control.

Where the parent organisation introduces automated office systems there will be a need for a system for the management of these records. The problems have been surveyed by Newton (1984), and some of the systems may be seen in operation at British Petroleum plc in London (Bartle & Cook, 1983, p.24).

V. Some problems and their solution.

Problems centring on hardware.

Computer systems need not only computing power but also an array of devices for inputting data and getting reports on processed data. These are termed peripherals, or input/output devices. Computing power can be provided either by a large central computer (a mainframe), by a single small computer (mini or micro), or by a linked network of small computers (microcomputers; now increasingly becoming known as personal computers). Peripherals would include a device for processing input data, and a device for reading the data held in the computer's memory. Both these jobs can be done by a terminal set up in a convenient place. This terminal may itself be a microcomputer. Finally, access to a printer is required.

It is not possible to advocate a single "best solution", because so much depends on the relationship between the archives or records service and its employing authority. If the service has an active RM programme, it will wish to be linked as closely as possible to the central administration. The records manager should be one of the participants in the central data base management system, or should be involved in the office communication system. The nature of this participation will no doubt determine the kind of equipment chosen. On the other hand, if the archives service functions mainly as a quasi-independent research institute, linked more closely with other such institutes than with its employing agency, it may make more sense to develop an independent computing facility.

A general principle might be that where the service is very closely integrated with a larger organisation, it may be more convenient to use the computing and data processing facilities offered by the central computing unit. Where there is no such close integration, modern microcomputers, with their large storage capacity, can serve as good and cheap data processing units. Probably the direction in which new technological developments are going suggests that independent computing (ultimately developing networks of compatible independent computers) is likely to carry important advantages. The overriding consideration in making a choice between the two main alternatives must be the service's own requirements and objectives. Forcing these into the conditions of a not entirely suitable computing service will inevitably lead to distortions.

Supporting and maintenance services are important. If small defects appear, or problems of a technical kind, archivists should be able to get expert advice, or technical remedies without delay. These are usually through the central computing service, so that a good relationship with this department is highly desirable. A maintenance contract with an efficient firm can be as valuable.

The question of obsolescence should be considered. No computer has as yet been used to the point of breakdown through old age. Consequently no-one knows how many years a given machine will last. Obsolescence has been a more important factor than wear. It is certain that anyone who operates a computer, small or large, will begin to think about replacing it after about 4-5 years, if not before. It will then be necessary to transfer the data and software to a new machine with the minimum of trouble. There is generally no overwhelming technical reason why this transfer should not be made, if the necessary questions are asked when the new equipment is being negotiated, but the existence of this problem does suggest that equipment made by a large manufacturer has an advantage.

Transferring data files from one machine to another is another situation where standard formats are useful. ISO 8211 lays down norms for such a format, and therefore could be valuable in ensuring the continued life of a database.

Compatibility is always a problem. As time goes on, other services - departments of the employing agency, other information services, or parallel archives services - acquire computers, or new computers. The new machines may not be apt for the development of networks or linkages. Since it is most likely that future communications systems will depend on these linkages, it is important that the question of compatibility be borne in mind when choosing hardware, and that the archives service is consulted when other related units get new material. For the same reason it is desirable for professional associations to examine the possibilities for future planning of automated systems in their areas, and make recommendations.

Problems centring on software

Software problems are likely to be more difficult than hardware ones, since with the latter simple questions of finance and availability are often dominant. Software can certainly be expensive, but it is of its nature much more portable, and questions of suitability to the needs of the service are vitally important. The software capability of the system must suit the objectives and structure of the archives service it is brought into, or there will be a failure.

Some software choices are determined by the make and kind of hardware selected. Mainframe manufacturers usually offer a range of packages when they make a sale. Archivists who have access to central computing services could therefore begin by making enquiries as to whether suitable packages are already held by that service. Administrative or financial computers may turn out to have information retrieval or bibliographic software installed which is not needed by the principal users. This situation has often been encountered by, for example, local archive services in

Britain (Patch, 1979). In the same way, it is often possible to get software packages included in the sale of microcomputers. Examples already quoted mention microcomputer users who have adopted packages such as dBase3, Delta or Cardbox Plus. These packages are very widely available off the shelf, and can be operated immediately (on appropriate machines) without any preparatory programming.

More usually, archivists seeking to automate some of their processes will look about for packages which might be suitable. Many of those available have already been mentioned in section 4 above. They seem to fall into two groups: bibliographical or information retrieval packages, and database management systems. Each has advantages and disadvantages. The evaluation of software systems was discussed above in Section III.

Bibliographical systems have the advantage that they are often cheaply and easily available, and, since they are widely used by library and documentation services, it is likely that they could be used for co-operative projects. On the other hand, there is the central problem that they are designed for item-by-item listing. It is important to be certain that the field structure used by the package is adaptable to the needs of archival description, and would not impose arbitrary restrictions. The other important question is the range of formats provided for output information.

The bibliographical package FAMULUS is used by several archives and museum services (Bartle & Cook, 1983). Developed for academic use, it is often available free to educational or research bodies, and it has been recently (1985) redesigned and updated. It allows a range of data structures, which would be suitable for many archival functions. Each record can be divided into up to 25 variable-length fields, and each field can contain up to almost 5000 characters without adaptation. This would mean that free text narrative administrative histories would probably not present a problem. In the output area, FAMULUS is not so flexible. Output in printout form is provided in only three alternative formats: as a numbered list of items, as an index grouped under the data in selected fields, and as a formal list set against field names. The package is essentially aimed at producing this kind of output, but it does also provide for online searches, of selected fields. FAMULUS was used to generate the specimen index displays in Fig.12.

Database management systems (DBMS) are even more widely available, since they are being promoted for the administration of small firms. DBMS are packages which allow different kinds of data to be stored in differently structured files, so that it can be retrieved on demand and displayed in various combinations. The most interesting variety of these packages, Relational Database Management Systems, allow data in one file to be displayed with data in others, and used to show significant factors when these relationships are brought into play.

- 1 CTRY Africa, East
DATE 1904 Sept 25 - 1919 Aug 3
CLAS F0794
DESC Eliot, Sir Charles; resignation as Commissioner,
Commander-in-Chief and Consul General for the East
Africa Protectorate (including the Mainland Dominions
of the Sultan of Zanzibar).
- 2 CTRY Africa, East; Pacific
DATE 1937 Mar 5
CLAS F093/95
REFC 33
DESC Extension of Extradition Treaty of 1911 to Zanzibar
and British Solomon Islands.
- 3 CTRY Africa, Southern
DATE 1930 Feb 13, 18
CLAS F093/77
REFC 100
DESC Agreements, Commerce, etc (Basutoland, Bechuanaland,
and Swaziland and Mozambique).
- 4 CTRY Arabia, Saudi; Jordan
DATE 1919 - 1924
CLAS F0686
REFC 59
DESC Claims for property devastated and treasures removed
from the Prophet's tomb at Medina.
FILE 15/1

1. Africa, East 1904 Sept 25 - 1919 Aug 3 F0794 Eliot,
Sir Charles; resignation as Commissioner,
Commander-in-Chief and Consul General for the East
Africa Protectorate (including the Mainland Dominions
of the Sultan of Zanzibar).
2. Africa, East; Pacific 1937 Mar 5 F093/95 33
Extension of Extradition Treaty of 1911 to Zanzibar
and British Solomon Islands.
3. Africa, Southern 1930 Feb 13, 18 F093/77 100
Agreements, Commerce, etc (Basutoland, Bechuanaland,
and Swaziland and Mozambique).
4. Arabia, Saudi; Jordan 1919 - 1924 F0686 59 Claims
for property devastated and treasures removed from
the Prophet's tomb at Medina. 15/1
5. Jordan 1920 Oct - 1921 Feb F0686 45 King Hussein
and his sons, Vol. IV 11
6. Jordan; Arabia, Saudi 1919 - 1924 F0686 King
Hussein; interviews with, etc, regarding his future
status. JP11

Africa, East

1904 Sept 25 - 1919 Aug 3 F0794 Elliot, Sir Charles; resignation as Commissioner, Commander-in-Chief and Consul General for the East Africa Protectorate (including the Mainland Dominions of the Sultan of Zanzibar).

Africa, East; Pacific

1937 Mar 5 F093/95 35 Extension of Extradition Treaty of 1911 to Zanzibar and British Solomon Islands.

Africa, Southern

1930 Feb 13, 18 F093/77 100 Agreement, Commerce, etc (Basutoland, Bechuanaland, and Swaziland and Mozambique).

Arabia, Saudi; Jordan

1919 - 1924 F0666 37 Claims for property devastated and treasures removed from the Prophet's tomb at Medina. 15/1

Jordan

1920 Oct - 1921 Feb F0636 45 King Hussein and his sons, Vol. IV 12

Jordan; Arabia, Saudi

1916 - 1918 F0666 King Hussein; interviews with, etc, regarding his future status. JP10

Fig.12

1-3 Alternative output formats from a single data input (FAMULUS).

Like bibliographical packages they are not necessarily adaptable to archival use. When testing a package for its suitability, it would be necessary to be certain that it will allow lengthy textual entries (some are limited to numerical data, or very short textual entries), and that it will permit searches of these entries. The ability of these systems to calculate from figures held in numerical files may be an unnecessary feature for archivists.

The DBMS known as SQL/DS (Structured Query Language/Data System) available on IBM computers is used for records management at Liverpool University. It allows the user to compile and structure as many different files as necessary, each file can contain a very large number of records, and these may have as many fields as are needed. Data held in different files can be combined, and there is a very powerful search capability which operates by selecting data items, combining them, and outputting them in a format which can be determined on screen. The corresponding disadvantage is that, since it is not designed for holding lengthy text, it is necessary to give specific instructions each time such text is retrieved. Specimens of file structure in this system are given in Figs. 5-7.

Archivists must think carefully about the methods to be used for inputting data to a system. The STAIRS information retrieval package, again widely used and available on many makes of computer (Cook, 1986, p.109) has the disadvantage that data entry is relatively difficult: it needs some extra programming, or the addition of other software to make it user-friendly in this respect. In fact it is generally necessary to add local facilities for data entry and user convenience when installing software packages at a local site. Consequently it is important to consider what local resources for this are available, and to what extent local systems can be maintained.

Obsolescence is also a problem with software. Packages are constantly being updated: it is now normal for a version number to be given with a package when it is bought. New versions will incorporate improvements or extensions to new hardware, but will not necessarily be directly compatible with the older versions. Local computing services introduce their own adaptations and improvements to software, which may make their private versions of the package impossible to use elsewhere. Although in principle software incompatibility can be overcome by further software work, this is often too expensive or not possible locally. Making a choice of software therefore implies a judgment on the future compatibility of the system chosen.

The standards proposed by ISO 8211 can be used as a partial insurance against problems in software transition.

Staffing problems

There are two aspects to the staffing problem: attitudes and training.

(i) Attitudes.

It is most important that the introduction of automation should not be undertaken against the feeling of the staff in post, especially the professional staff. It is in fact most unlikely that bringing in computers will result in the reduction of professional staffing levels, so that fears of redundancy may be allayed after explanation. However, it is certain that automation will change habits and methods of working, and the staff have it in their power to prevent the full achievement of the objectives of a new system, if they wish to withdraw their active co-operation.

The usual way to avoid this kind of misunderstanding is to undertake changes only after consultation with the professional staff. The new project may then emerge as the result of that consultation, and in the form of an agreed plan. Additionally, there will probably be scope for those members of staff who are particularly interested, to take on new responsibilities in carrying out the initial analysis, and in supervising the introduction of new methods.

(ii) Training.

Questions of curriculum and level were discussed in the first part of this study.

The Automation Committee's international survey in 1985 enquired into the provision of training for staff involved in automation projects. Most replies indicated that archivists got their training by self-education: by reading books like this one, discussing technical questions with experts and doing what practical exercises they could find.

Another common form of training was by attending courses provided by computer manufacturers or computer marketing firms. Such courses are widely available, but they have the disadvantage that they are (naturally) geared to explaining the powers of one particular manufacture or system. Such courses may be very valuable (and when it is a question of training operatives for running a system which has been installed, indispensable), but they do not take the place of a broad training which will develop the students' power to examine systems critically and in comparison with each other.

In a few other cases, there were courses in computing available in institutions of technical or higher education, which staff members could attend. This too is a valuable resource, but such courses are often too much directed to the needs of scient-

ific research, or of business administration, to be directly relevant to information workers.

Some archives services began their automation by recruiting new staff, with a requirement that candidates should have appropriate experience.

It is clear that in general the question of staff training has to be considered as one of the important matters involved in bringing in automation, and resources should be allocated to deal with it.

Costs

Introducing automation will involve capital and recurrent costs, but these may be set against savings on manual systems. The process therefore begins with an analysis of the costs of current manual systems. Unfortunately it is not easy to estimate these accurately, and there appear to be few or no published studies (Cook, 1986, pp.48-52).

Capital costs cover the purchase and installation of hardware, and the initial purchase of software. Capital expenditure is minimised where there is maximum use of central services. Where there is strong support from these, expenditure in the archives service itself could be as low as the equivalent of US\$4000, to cover the installation of a terminal, printer and modem, to operate in connexion with a mainframe computer already available. Alternatively, an independent microcomputer system would not necessarily have a higher cost than this.

Recurrent expenditure is largely on maintenance of both hard and software, and on consumables such as stationery. There may be a charge for computer time, in cases where the repository is using a central service. None of these costs is likely to be notably higher than corresponding costs in a manual service.

It is common for computer systems to be installed as a result of a specially funded experimental project. If a supporting agency can be found, this is an excellent way to undertake automation, for it allows for buying in expert analysis and supervision without taking on long-term commitments. There should however be a plan for maintaining the system after the end of the project.

Problems connected with systems planning

(i) Objectives.

The essential difficulty is that without a clear view of the objectives to be met by the system, archivists cannot proceed to plan or acquire any equipment; yet without an idea of what equipment is available, it is difficult to come to a decision on the ultimate objectives.

- (a) Type of output or access envisaged: printout of inventories; printout of search results, or of specialised handlists; online search by staff or by users; remote use?
- (b) Relationship with central services and with other information services; co-operation or networking?
- (c) Data and sources to be included, and method of data capture and processing.

(ii) Technical questions.

- (a) The bulk of data to be processed and stored.
- (b) The length of time automated data is to be held. Longterm storage will involve setting up some form of data archive, and/or provision for transferring files to future new systems.
- (c) System security: making sure that there is no distortion or loss of data by unauthorised access or by improper processing.

(iii) Planning for the future.

Eventually the existing installation will become out of date, and both hard and software will have to be replaced. The new system should be an enhancement of the old, but should be able to use the databases compiled over the years.

Enhancement of the system will certainly involve questions of co-operation with one or more of the following:

- (a) the central administration of the employing agency: the introduction of electronic communication systems will involve records and archives management.
- (b) Information services operating in the locality: the likelihood of a Local Area Network (LAN) being developed.

- (c) Information services operating nationally: national networks and registers.
- (d) User groups, especially those organised in institutions of scientific or academic research.

Automation in small, poorly financed archives services and in developing countries.

Provided that the technical infrastructure is present (as described in section 1), there is a very strong case for introducing automated methods into small and underfinanced archives and records services. The case would be strongest where the service has only one professional archivist or records manager, with minimal supporting staff. In this case it is important that the professional's output should be maximised, and that his or her control over all the processes of the service should be maintained. Automated methods are the way to ensure this, provided that time can be found for the initial planning. As indicated in section V, the investment in financial terms is not by most standards a major one.

A good example of self-help and the intelligent use of local resources is that of the South Humberside Area Record Office, in England (Bartle & Cook, 1983, p.35). This system is based upon a popular Commodore 64K microcomputer with a cheap Centronics printer and double disk drives. This means that the initial capital expenditure was probably less than US\$500. The programs were written by the archivist in charge, using a variant of BASIC, supplied, together with user manuals, with the machine at the time of purchase. Initially the data input consisted of descriptions at series level, structured into 7 fields (reference code, title, dates, provenance, accession date, location and notes). Later item-level descriptions were added, and a simple search facility brought into use. Since data was held on 162K diskettes, initial sorting of these had to be done manually, but a change to hard disks would avoid this need. Remote access was planned at the administrative headquarters some miles away. The objective was primarily to improve the productivity of the small team, who were being overwhelmed with new accessions of material which could not be listed fast enough to keep pace.

The same principle operates in developing countries. Archives and records services here are likely to have the advantage that they are attached directly to central government, and so are close to sources of decision in information, finance and technical services. The pioneer was probably the Archives Nationales of the Cote d'Ivoire, which undertook an automated system for retrieving information from the archive of official bulletins. The system was introduced in 1975 and ran for some years. A

terminal linked to the central government computer was used, employing the information management package MISTRAL, which was available on the machine.

The National Archives of Malaysia has a pilot project now operational, using a Canon AS-100 microcomputer and a standard software package, dBase2. The pilot project is to compile a database of national pension records; that is, important administrative records which have to be managed and retrieved reliably. It is proposed to extend the system next to group/collection level descriptions. An active programme for training specialists from among the professional staff is in progress.

Automation is under active consideration in several areas of the southern hemisphere, notably in Latin America (for which the ICA Automation Committee ran a training workshop in 1985), South-east Asia and the Pacific countries. Professional colleagues in these regions recognise, in broad terms, the benefits which well-designed automation projects will bring, but find that infrastructure and training are constraints. Comparative measurements of productivity using automated methods and manual methods will usually show that cost should not be an important factor.

Computers have provided the first important new tool for archives and records management since the invention of the typewriter a century ago. Some archivists initially resisted the new methods because they felt that they were inappropriate; some because of the cost of reinvestment. We are now at a point in history when it is possible to see that the new methods are very relevant and appropriate to all forms of information management, and that the cost of running them is likely to be comparable to the costs of manual methods. The new ways do indeed demand that archivists should rethink their aims and strategies; but this is good in itself, and leads to a new vigour and enthusiasm among a professional staff given new goals and a new stimulus to achievement.

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